REMARKS

Claims 1-19 are pending in the application.

The specification is amended to correct typographical errors and to include cross-reference to related applications and USPTO recommended headings and subheadings.

Claims 1-19 are amended to improve the quality of the original translation from German into English and to conform to common U.S. practice for claims recitations.

Claim 1 is additionally amended to specify that the feed stream within the at least one disk outflows directly into a single mixing zone and that the microstructure units (6) are in contact with said mixing zone. Support for this amendment may be found throughout the specification. By way of specific examples, support may be found on page 3, last complete paragraph; the paragraph bridging pages 3 and 4; and Figures 1-5 and their corresponding descriptions in the specification. The cited examples and descriptions of disk-shaped components comprise a single mixing zone.

No new matter is added.

Claims Rejections 35 U.S.C. 103

Claims 1-19 are rejected under 35 U.S.C. 103(a) as being unpatentable over **Hemming** (ISBN 3-8023-0084-X, pp158-9) in view of **Ehrfeld** et al. (US 2003/0039169 A1). The Examiner's rejection has been carefully considered.

Applicant argues that claims 1-19 are not unpatentable over Hemming in view of Ehrfeld because the cited references do not teach every limitation recited in claim 1, as amended. Specifically, neither reference teaches or suggests microstructure units (6) that divide a linking channel into two or more part channels immediately before opening into a single mixing zone and wherein the microstructure units (6) are in contact with the mixing zone.

The disk shown in Figure 3a of Ehrfeld shows an inlet channel that is sequentially bifurcated to produce multiple separate channels that open into a mixing zone. There is no structure present in Fig 3a or described in the text of Ehrfeld that can reasonably be confused with the microstructure units recited in claim 1, as amended. The terms "microstructure unit" and "microstructure part" are described and defined in the context of a linking channel in the present claims and specification. Microstructure units and part channels are described in the last complete paragraph on page 3 of the present specification. A part channel is formed by the division of a feed stream into part streams by microstructure parts just before the outflow of the feed stream into the mixing zone.

Ehrfeld describes a structure that is clearly structurally distinct from any structure recited in the present claims. Paragraph 51 in Ehrfeld teaches that a supply channel is sequentially bifurcated in stages to form a plurality of microchannels. The structures (material) that separate the initial channel into successive daughter channels are structurally distinct from the microstructure units recited in present claim 1 in several respects. For example, the material separating the first channel into two separate microchannels by the first bifurcation according to Ehrfeld is not in contact with the mixing zone. Addtionally, this separation of the parent channel does not occur immediately before the channel flows into the mixing zone.

The micromixer taught by Ehrfeld requires at least two stages of bifurcations in fluid streams leading to a mixing zone (abstract). The sequential bifurcation of a channel into a plurality of distinct microchannels before outflow into a mixing zone cannot reasonably be equated with a single channel that is divided into a plurality of part

channels by microstructures just before outflow into a mixing zone. A "bifurcation" as described Ehrfeld is clearly the separation of one channel into two channels. As such, a "bifurcation" cannot be confused with a "microstructure unit." Similarly, daughter "channels" formed by the bifurcation of a parent channel, as described in Ehrfeld, cannot be confused with "part channels" formed by microstructure units at the opening of a channel into a mixing zone, as described in the present specification.

In view of the amendment to claim 1 and the foregoing arguments, Applicant respectfully requests that the rejection of claims 1-19 under 35 U.S.C. 103(a) as being unpatentable over Hemming in view of Ehrfeld be withdrawn.

Claims 1-19 are rejected under 35 U.S.C. 103(a) as being unpatentable over **Hemming** (ISBN 3-8023-0084-X, pp158-9) in view of **Vanden Bussche** et al. (US 2002/0187090).

Applicant argues that claims 1-19, as amended, are not unpatentable over Hemming in view of Vanden Bussche because the cited references do not teach every limitation recited in claim 1. Specifically, neither reference teaches or suggests microstructure units (6) that divide a linking channel into two or more part channels immediately before opening into a single mixing zone and wherein the microstructure units (6) are in contact with the mixing zone.

Vanden Bussche teaches a micromixer for performing catalyzed chemical reactions (abstract). The basic embodiments of the micromixer includes a mixing chamber at least two supply conduits for injecting fluid into the chamber ([0020]). The supply conduits open into the mixing chamber in a manner to form a fluid spiral flowing concentrically inward. Supply conduits are preferably distributed symmetrically around the mixing chamber. The supply conduits may deliver premixed fluids ([0027] and [0030]). Paragraphs [0035], [0036], and [0054] – [0056] and Figures 2 and 3 describe micromixer embodiments in which premixing is accomplished by dividing each of two

separate feed streams (26) and (28) into a plurality of distribution conduits (20) and (22) and then delivering fluid from the distribution conduits into the inlet of a manifold (24), that is in fluid communication with the mixing chamber 14' via a conduit 10'. Paragraph [0055] teaches that the velocity of the fluids in the distribution conduits is lower than in the feed stream and that the cross-sectional area of the premixed fluid flow must be reduced via conduit 10'. Paragraph [0018] teaches that slowing the flow during mixing is helpful because some reactions require loner residence times.

In summary, Vanden Bussche teaches a micromixer having a mixing chamber into which fluids to be mixed are injected via supply conduits, preferably arranged symmetrically around the mixing chamber. Premixing of fluids to be injected may be accomplished using a manifold containing distribution conduits that empties into the mixing chamber via single conduit.

In the rejection, 14' in Figure 2 of Vanden Bussche is correctly cited as a mixing chamber. Fluid distribution conduits 20, 22 are cited as teaching a linking channel that opens into a mixing zone and is divided by microstructure units into two or more part channels. The mixing zone identified in the rejection, however, is not the mixing chamber 14', it is part of manifold 24 which communicates with the mixing chamber 14' via a conduit 10'. Claim 1, as amended, recites a micromixer comprising at least one component in the form of a disk (1) wherein said disk (1) comprises a single mixing zone (5). If the area of the manifold is equated with the mixing zone recited in the present claims, then mixing chamber is a second mixing zone.

Additionally, the distribution conduits taught by Vanden Bussche are not part channels separated by microstructure units immediately before opening into a mixing chamber. Rather, Vanden Bussche teaches the premixing of fluids before their introduction into a mixing chamber. Quite contrary to the structure of the presently claimed method, the premixed fluid is gathered into a single channel before it is introduced into the mixing chamber. Every embodiment of the micromoxer taught by Vanden Bussche comprises single conduits entering the mixing chamber. There is no

hint provided in Vandedn Bussche that there is any advantage to dividing a supply conduit into multiple part-channels at the junction of the supply channel with the mixing chamber (i.e. immediately before opening into the mixing chamber).

Applicant argues that one of ordinary skill in the art would have had no motivation to combine the teachings of Hemming and Vanden Busshe. The micromixer taught by Vanden Busshe is specifically designed for catalyzed, diffusion limited chemical reactions and contains catalyst. The various embodiments are designed to account for potential side reactions and their rates, rates of product formation, and premixing of reactive species. One wishing to perform an extraction would not have been motivated to use an apparatus designed for high speed chemical reactions. One of ordinary skill in the art would not consider performing chemical extractions such as those taught by Hemming using a micromixer specifically designed catalyzed chemical reactions because extraction processes do not require fast mixing and premixing as do catalytic chemical reactions. The extractions taught by Hemming can be accomplished as well or better using much simpler and cheaper methods than those taught by Vanden Busshe.

In view of the amendment to claim 1 and the foregoing arguments, Applicant respectfully requests that the rejection of claims 1-19 under 35 U.S.C. 103(a) as being unpatentable over Hemming in view of Vanden Bussche be withdrawn.

Conclusion

The application in its amended state is believed to be in condition for allowance. Action to this end is courteously solicited. Should the Examiner have any further comments or suggestions, the undersigned would very much welcome a telephone call in order to discuss appropriate claim language that will place the application into condition for allowance.

Respectfully Submitted,

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